SHOULDER-BELT-PORTION GUIDING ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATIONS

This is an application of US-serial number 10/690,740 related to a division of an international application number PCT/DE98/03270 (WO 99/24294, European Patent EP 1 037 773 B1, German Patent DE 197 49 780 C2) filed Nov. 10, 1998.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

It is an object of the present invention to enhance the comfort of belt users of a transport system (motor vehicle, ship, train or aeroplane) and the survival chance in the event of any accident (front-, side-, rear-end collision and/or rollover or pile up/mass collision) or during in-flight turbulence.

2. Discussion of the Prior Art:

It is known in the prior art to provide for a passenger of the vehicle a seat belt, equipped with

- a shoulder-belt-portion guiding deflector with fixed height to enhance survival chance in a front-end crash or comfort or to integrate the seat belt into the seat;
- a shoulder-belt-portion guiding deflector upwardly moved in a front-end crash and
- a shoulder-belt-portion guiding deflector up- or downwardly moved when the shoulder belt portion comes into contact with a top or bottom pressure sensitive switch.

Under constraint of great deformation of the post section **91**, in which an extending belt portion of the seat belt, equipped with a belt retractor **13**, having a clamping device, is arranged (**Fig.** 1), the shoulder belt portion, loosely guided by a conventional height-adjustable D-ring **12**, attached to the post sections (pillars, pillar portions), or strangulates the neck of the belted passenger and/or injures the aorta of his neck in real-world side-crashes, causing instant death.

Passenger, wanting to use the seat belt **1**, must make an effort to grasp the main latch plate **9**, when in resting position behind the seat backrest **3.2** or below the seat cushion **3.1** between it and the door.

In order to formulate in single terminology a generalized definition is presented for the proper term:

Definition:	**Proper Term:**
"Transport system"	Motor vehicle or train or ship or aeroplane
"Belt deflector **5a, 5c, 12c, 17c**"	Shoulder-belt-portion guiding deflector **5a**, belt deflector **5c, 17** or D-ring **12** (**Figs.** 1, 5, 6A, 7, 8, 9)

Ref. to US No. 5,570,933 both the shoulder belt portion of the three-point seat belt, loosely guided by the shoulder-belt-portion guiding deflector with fixed height, fixed to the seat backrest on the top and side edges, and the lap belt portion are attached to the post section. This shoulder-belt-portion guiding deflector with fixed height is uncomfortable for a passenger of extreme body proportion, when using the seat belt.

The head/neck motion of whiplash begins when a motor vehicle is decelerated in a front-end crash. The belted passenger is thrown backwards into the seat backrest by his mass inertia force, his torso moves up along the seat backrest, when the angle „Ω" (**Fig.** 1) is less than 70^0, and his head rotates rearwards about the head rest, when adjusted too low, unlocked and/or having little stiffness, while bending or extending his neck. Then his head and torso, rebounding forwards, are thrown forwards by his kinetic energy while rotating his head forwards. The oscillation of his head and torso occurs until his kinetic energy is dissipated by the work thereof . In three front crashes an obese female driver of a Ford Mondeo slipped downwards underneath her seat belt during which the airbag fractured her head and intruded her face plane into her skull. This submarining results from the mass of the lower part of the body being far larger than that of the upper part. Up till now agencies have not yet investigated submarining resulting from the obesity, wrong angle of the seat backrest and the stiffness of seat pads in front-end crashes.

Similarly, the head/neck motion of whiplash begins when a motor vehicle is accelerated in a rear-end crash. The belted passenger is thrown backwards by his mass inertia force into the seat backrest, his torso moves up along the seat backrest, when the angle „Ω" is less than 70^0, and his head rotates rearwards about the head rest, when adjusted too low, unlocked and/or having little stiffness, while bending or extending his neck. Later on, his head and torso, rebounding forwards, are thrown forwards by his kinetic energy while rotating his

head forwards. The oscillation of his head and torso occurs until his kinetic energy is dissipated by the work thereof. It lasts up to 400 milliseconds in one of the 34 sledding tests, run by HUK Verband and Technical University in Graz, Austria, in which 9 seats, one of which is Porsche 911's seat IIHS, were rated good, and 22 participants were subjected to rear-end crashes at very low speeds between 8 and 11 km/h.

AIS is an acronym for Abbreviated Injury Severities ranging from 0 for unscathed to 6 for fatality. Due to high AIS, injury costs of more than $ 30 billion annually and loss of productivity NHSTA, IIHS, Insurance Institute for Highway Safety in Arlington, Allianz, the largest German Insurer, and HUK Verband, the German Insurer Association, have investigated and are still investigating the phenomena "head-, neck- and whiplash injuries" and published their findings and suggestions how to prevent them to a large extent. Four Status Reports [SR1 to SR4], issued by IIHS 06/08/1995, 04/12/1997, 05/22/1999 and 04/28/2001, the HUK Verband's test report and the report "U260901" of Ford Mondeo's accident are incorporated herein.

IIHS and Allianz [SR2], both confirm the importance of locks on height-adjustable head rests or lock devices to prevent head and neck injuries resulting from the heads pushing the unlocked head rests down. The pushing down of head rests, for example, of Ford Taurus, shown in photos of [SR1], is verified in tests at very slow speeds, precluding tests at higher speeds. Furthermore, IIHS, Allianz and HUK Verband make a general recommendation that the head rest may neither be designed too low nor adjusted too low, not lower than the point of gravity of the head.

Ref. to pp. 2/lines 48 – 55 of US 5,330,228, claiming the priority of the German Application Doc. DE 40 10 452 A1 incorporated herein, and the Summary and Claim 1 of DE 40 10 452 A1, the head rest 7, when adjusted too low, moves upwardly to an appropriate height in a front-end crash until a straight line of the shoulder belt portion is formed between the D-ring 11 of the post section (**Fig.** 12) and the point of contact between the shoulder and the shoulder belt portion when the passenger is thrown forwards.

This feature works under the premise that the head rest is adjusted too low and unlocked, thus contradicting the findings of IIHS, HUK Verband and Allianz. Before being thrown forwards either in a front-end or rear-end crash, the passenger is thrown backwards. When he is obese, heavy and over 2 metres tall, his head under great force easily presses the head rest down, adjusted lower than the point of gravity of his head. Hence, he has already

suffered head-, neck- and whiplash injuries before his head rest can be adjusted to the appropriate height by the invention. Nor can an electronic motor, proposed in a second embodiment, raise his head rest to the appropriate height within 2 to 5 milliseconds! Moreover, in the front-end or rear-end crash the oscillation of the head/torso pushes the unlocked head rest down and up alternately.

Because the head rests are unlocked passengers' heads are crushed by the vehicle roof in rollover accidents.

In the second embodiment a shoulder belt deflector has a square-shaped hole, defined by a left and right edge, a top edge, to which a top pressure sensitive switch is attached, and a bottom edge, to which a bottom pressure sensitive switch is attached. When moving up- or downwardly the shoulder belt portion, located in the square-shaped hole, comes into contact with the top or bottom pressure sensitive switch 23, 29 (**Fig.** 13). In the case the shoulder belt portion exerts pressure on the top pressure sensitive switch, the unlocked head rest is moved upwardly. In the case the shoulder belt portion exerts pressure on the bottom pressure sensitive switch, the unlocked head rest is moved downwardly. During the oscillation of the head, neck and torso over a long period in a real-world front-end or rear-end crash the shoulder belt portion alternately activates the top and bottom pressure sensitive switch in association with the up- and downward movement of the head rest until the shoulder belt portion comes to rest, during which the passenger suffers head-, neck- and whiplash injuries. Furthermore, when the vehicle travels fast over bumpy roads the shoulder belt portion oscillates. It activates the top and bottom pressure sensitive switches 23, 29 alternately! All these features can meet neither customers' satisfaction nor the US- and EU-rules nor the coming global standard.

US 5,733,013 addresses an "energy-absorbing" restraint system, comprising a three-point seat belt, belt retractor, latch plate, buckle assembly, shoulder belt deflecting apparatus, obliquely arranged to a fixed head rest, and mounting apparatus for mounting the belt retractor on a top portion of a seat backrest by means of a shear pin and a bolt. The height-adjustable, one-piece belt deflector **5, 5b, 5.10c** is far cheaper to manufacture, far easier to assemble, more effective and far lighter than the shoulder belt deflecting apparatus with fixed height, defined by many non-standard parts and few standard parts. Moreover, the adjustable height of the shoulder belt portion, inserting through a slot of the shoulder belt deflecting apparatus, is limited by the width thereof.

The following "energy-absorbing" feature is unsubstantiated. According thereto in pp. 5/lines 56 – 65 the shoulder belt portion can "rotate" the belt retractor about the bolt, thus "dissipating" great belt force by "fracturing" the shear pin in excess of a threshold value thereof. If this is true, the adjustment of the height of the shoulder belt portion associated with the downward movement of the shoulder belt portion, *limited* by the width of the slot, would always shear the shear pin. As a result, no adjustment could be made anymore! How can the shoulder belt portion, made from *flexible webbing*, "rotate" the belt retractor, tightly fastened by the shear pin and the bolt, and "exert" torque about the bolt thus resulting in "fracturing" the shear pin?

US 5,897,169 addresses a rotatable shoulder belt deflector, comprising a mounting member, having an aperture adapted to rotate about an outboard head-rest tube **5.10**, and a belt deflector, having an opening for receiving a shoulder belt portion of a three-point seat belt. The pivotal movement of the mounting member about the outboard head-rest tube is mentioned therein, but the purpose thereof is not disclosed.

US 5,599,070 teaches a three-point seatbelt and a turning mechanism, resolving the shortcomings of the shoulder belt deflecting apparatus, above-mentioned, and fixed to the seat backrest on the top edge and comprising eight non-standard parts, one of which is a bezel, rotatable in the longitudinal axle of the turning mechanism and having an exit slit, through which the shoulder belt portion **1.2** is extended over the shoulder of a belted passenger.

US 5,658,015 addresses a three-point seatbelt and a gimbaled web guide, having a belt deflector, through an exit slit of which the shoulder belt portion **1.2** is extended over the shoulder of a belted passenger, and a gimbaled support structure for receiving the belt deflector and enabling it to rotate about at least two perpendicular axes.

The height-adjustable, one-piece belt deflector **5, 5a, 5b, 5.10c** is far cheaper to manufacture, far easier to assemble, more effective and far lighter than the gimbaled web guide with fixed height, defined by many non-standard parts and few standard parts, or the turning mechanism of US 5,599,070.

Passengers with a height of less than 1.5 m or more than 2 m feel uncomfortable, wearing seat belts, due to the limitation of the height-adjustment of the D-rings **12** or the fixed height of the seat-belt-turning mechanisms or shoulder-belt-portion guiding deflectors.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to provide for passengers of a transport system shoulder-belt-portion guiding assemblies which in co-operation with head rests meet the US- and EU-rules as well as the coming global standard, increase convenience and comfort, prevent to a large extent head-, neck- and whiplash injuries and strangulation in the event of an accident or during in-flight turbulence, resolve all the above-mentioned shortcomings and are suited for three-point to multi-point seat belts.

When the shoulder belt portion **1.2** covers the face of a small passenger he must adjust the head rest downwards. When the shoulder belt portion **1.2** exerts pressure on the shoulder of a tall passenger he must adjust the head rest upwards. This feature makes the pressure sensitive switches of US 5,330,228, the control unit, motor, pinion gear and tooth rack assembly superfluous and saves money, time and life in real-world accidents.

Ref. to [SR4] conventional head rests in most cars are inadequate, neither high enough nor close enough to the head of the passenger in order to prevent head-, neck- and whiplash injuries in real-world accidents. A mandate for higher head rests will bring US rules in line with the height requirements of the tougher EU standard. In addition, the US rule will require head rests to be close to passengers' heads. "The proposed revisions should result in fewer whiplash injuries", concludes Brian O'Neill, President of IIHS. An international group has been charged with finding new dynamic tests that shall result in a global standard for preventing whiplash injuries.

The EU legislators as well as the FAA managers have requested the inventor to submit new specifications and his concern over the conventional ones, which are life-threatening over decades. The letters are incorporated herein.

A second object of the present invention resides in a cost-, space-saving integration of a height-adjustable shoulder-belt-portion guiding deflector, a head rest and the shoulder-belt-portion of a three- or multi-point seat belt into the shoulder-belt-portion guiding assembly.

INDUSTRIAL APPLICABILITY

It should be apparent that the invention provides substantially more convenience, lower costs and greater survival chance including the following features:

a) When an AUDI A3, crashing at a speed of 80 km/h into a small-sized Ford, is yaw-accelerated at a yaw angle of 390^0, the seat of an obese female co-driver, wearing a three-point seat belt, is laterally deformed at about 5 cm by the crash loads. The report "OBESITY" and the appl. US 09/554,464 (EP 1 037 771 B1, DE 197 58 498 C2) are incorporated herein. All the inventors of the cited references US 5,330,228, US 5,599,070, US 5,658,015, US 5,733,013 and US 5,897,169 have neglected additional loads which result from guiding the shoulder belt portion **1.2** and crash loads to which the seat-backrest frame **3.4** is subjected in real-world accidents. To prevent total deformation of the seat and severe/fatal injuries the belt force, resulting from the loads pulling the extending belt portion **1.4** and the belt retractor **13b**, has to be gradually absorbed by vibration-dampening energy absorbers ref. to US 09/554,464, attached to holes **1.61** of coupling fittings **1.2b**, and by two pairs of sites of predetermined fracture "s" of a girder **3.20d** of the seat-backrest frame **3.4** in excess of the respective threshold values (**Fig.** 11). At the same time strong vibration is dampened by the energy absorbers. The belt retractor **13b** can be forced up to the upper edges of the pair of top oblong holes **3.53.** See Claim 16.

b) In compliance with the global standard in the near future the head rest **3.6a, 3.6b, 3.6c** has a pair of head-rest tubes **5.10** or a single head-rest tube **5, 5b, 5.10c** (**Figs.** 2, 5), where the head-rest tube **5.10, 5, 5b, 5.10c** engages with an appropriate locking slot „L_2" or „L_3" (**Figs.** 6A, 6B, 8, 9) and locked by a biased latch **3.65, 5.65** of locking device **80. 80c**.

c) Doubtless, the locking device **80. 80c** can be equipped with an electrical motor, which, when activated, rotates a pinion gear (not shown) raising or lowering a cog rack, which is a lower portion of the head-rest tube having a plurality of locking slots or teeth „L_1" to „L_n", where i = 1 to n.

d) The use of the height-adjustable shoulder-belt-portion guiding deflector **5, 5b** (**Figs.** 1, 3), an upper portion of which projects through the top edge of the seat backrest, makes the conventional height-adjustable D-ring **12**, attached to the B-, C- or D-post section **91**, shown in **Figs.** 1, 3, unnecessary.

e) In another embodiment the shoulder-belt-portion guiding deflector **5a, 5c** (**Figs.** 2, 7) can be rigidly attached to the head rest **3.6a**.

f) High retail price results from costs of tooling and manufacturing and the annual production of just a few Ferrari and Porsche cars, having fixed head rests equipped with shoulder-belt-portion guiding deflectors **5, 5b, 5.10c**. In order to lower the retail price the suppliers have to offer to other car-, train- and aircraft companies the same deflectors **5, 5b, 5.10c** converted into single head-rest tubes **5, 5b, 5.10c** (**Fig.** 5 to 11) each of which having a free-end of upper portion to which any head rest **3.6b, 3.6c** (**Figs.** 5, 7) can be fastened. See further in Chap. g) below-mentioned.

g) To dramatically lower the retail price belt deflectors **5c**, each of which provided with a pair of longitudinal attachment holes **5.23** and a pair of transverse attachment holes **5.22** (**Fig.** 7), are suitable substitutes for D-rings **12**, lower belt deflectors **17** (**Figs.** 1, 7) and shoulder-belt-portion guiding deflectors **5a** (**Fig.** 2), having only the pair of longitudinal attachment holes **5.23**. The opening gap „g" (**Fig.** 9) can be varied if needed.

h) Conventional head rest **3.6a** has a pair of head-rest tubes **5.10** governed by two tolerances. This causes a problem of canting. In worst case, when both longitudinal axes „z_1" and „z_2" are out of alignment, the head-rest tubes cannot be assembled into the seat backrest at all. In order to resolve all the shortcomings and ensure smooth movement of the shoulder-belt-portion guiding deflector **5b** along the guide tube **3.9b** or the single head-rest tube **5, 5b, 5.10c** along the girder **3.20, 3.20c, 3.20d**, the pairs of contact portions **3.91b / 5.11b; 3.81 / 5.81; 3.45 / 5.45** are each governed by only a single tolerance „$\pm \Delta r$"; „Δt"; „$\pm \Delta r_1$", respectively (**Figs.** 4, 5, 6A to 6C, 7, 8).

i) Cost and weight reduction is achieved by use of extrusion components, made from light metal such as aluminium, magnesium or combination thereof, for girders **3.20, 3.20c, 3.20d**, shoulder-belt-portion guiding deflectors **5, 5b**, single head-rest tubes **5, 5b, 5.10c** and guide tube **3.9b**.

j) Any adjustment of the height of the head rest **3.6a to 3.6c** (**Figs.** 5, 6A, 6B, 7) to the head automatically adjusts the height of the shoulder-belt-portion guiding deflector to the shoulder.

k) The tragedy, linked to neck-strangulation, above-mentioned, is, to a great extent, averted by the shoulder-belt-portion guiding deflector in conjunction with a feature of arranging the extending belt portion and the belt retractor in the seat backrest and arranging the belt end of the lap belt to the seat frame.

l) For the convenience of the passenger, when stepping out, the shoulder-belt-portion guiding deflector intercepts and loosely retains the released main latch plate **9**, which is loosely held by a main-latch-plate adaptor **40** (**Figs.** 1, 1A to 1C) fastened to the lap belt portion. He or another passenger, when taking the seat and wanting to use the seat belt, easily accesses the released main latch plate on the shoulder-belt-portion guiding deflector. See an alternative feature for easy access thereof, undermentioned.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying drawings with reference to the xyz global coordinate system:

Fig. 1 is a perspective view of a seat equipped with a 1st embodiment of a height-adjustable shoulder-belt-portion guiding deflector **5**, having an aperture **5.9** and a locking handle **5.2** of a 1st embodiment of a locking device **80**, and a three- or multi-point seat belt **1**, having a lower belt deflector **17**, D-ring **12** and a main latch plate **9**, which, when the seat belt is used, is plug-in connected to a main buckle assembly **9.1** in an operative position „U" (acronym for Use) or, when the seat belt is not used, loosely retained by a main-latch-plate adaptor **40** in a resting position „NU" (acronym for Non-Use).

Fig. 1A is a cross-sectional view of the main-latch-plate adaptor **40** and a lap belt portion **1.3** of the seat belt **1** along the line A-A of **Fig.** 1.

Fig. 1B is a cross-sectional view of two pieces **40.1, 40.2** of the main-latch-plate adaptor **40** along the line A-A of **Fig.** 1.

Fig. 1C is an enlarged cross-sectional view of the piece **40.2** having two chamfers **40.22, 40.23**.

Fig. 2 is a perspective view of a 2nd embodiment of a shoulder-belt-portion guiding deflector **5a**, attached to a height-adjustable head rest **3.6a**, having a pair of head-rest tubes **5.10**.

Fig. 3 is a perspective view of a fixed head rest **3.6** and a 3rd embodiment of a height-adjustable belt deflector **5b** having a locking handle **5.2c**.

Fig. 4 is a cross-sectional view of the height-adjustable belt deflector **5b** moveable along a guide tube **3.9b** of a seat-backrest frame **3.4** and guided thereby along the line B-B of **Fig.** 3.

Fig. 5 is a schematic, front view of a single height-adjustable head-rest tube **5, 5b, 5,10c**, having the locking handle **5.2** or a locking handle **5.2c** of a 2nd embodiment of a locking device **80c** and the aperture **5.9** or a belt deflector **5c**, a head rest **3.6b, 3.6c**, attached to an upper portion of the head-rest tube **5, 5b, 5,10c**, and a pair of girders **3.20, 3.20c, 3.20d** of the seat-backrest frame **3.4**.

Fig. 6A is a cross-sectional view of a 1st embodiment of the single head-rest tube **5**, having the aperture **5.9** and moveable along the girder **3.20**, guided thereby and locked therein by a latch **3.65** of a locking device **80** with the locking handle **5.2**, along the line D-D of **Fig.** 1.

Fig. 6B is a side view of the single head-rest tube **5**, provided with a plurality of locking slots „L_1" to „L_n" („L_2", „L_5" to „L_8" drawn), where i = 1 to n, and locked at the locking slot „L_2" in position „C" (acronym for Closed position) by the latch **3.65** according to the arrow „P" of **Fig.** 6A.

Fig. 6C is a cross-sectional view of slanting members **3.81, 5.81** of each of a pair of V-shaped contact-portions **3.60, 5.60** according to the circle „R" of **Fig.** 6A.

Fig. 7 is a perspective view of a 2nd embodiment of the single head-rest tube **5.10c**, moveable along the girder **3.20c**, guided thereby and locked therein by a latch **5.65** of the locking device **80c**, of the belt deflector **5c, 12c, 17c** and head rest **3.6c**.

Fig. 8 is a cross-sectional view of the locking device **80c**, belt deflector **5c**, attached to the single head-rest tube **5.10c**, girder **3.20c** and a locking handle **5.2c** along line C-C and the line F-F of **Fig.** 5.

Fig. 9 is a cross-sectional view of the belt deflector **5c**, single head-rest tube **5.10c**, provided with a plurality of locking slots „L_1" to „L_n" („L_1" to „L_7" drawn), where i = 1 to n, and locked at the locking slot „L_3" by the latch **5.65** along the line E-E of **Fig.** 8.

Fig. 10 is an enlarged cross-sectional view of a tube-wall **5.44** of the single head-rest tube **5.10c** and a pair of connecting threaded rivets **5.33**.

Fig. 11 is a perspective view of a belt retractor **13b** and a pair of coupling fittings **1.2b**, all of which are attached to a 3rd embodiment of a girder **3.20d**, provided with an oblong hole **3.25d** and two pairs of sites of predetermined fracture „s".

Fig. 12 is a schematic side view of a height-adjustable head rest 7, which, unlocked, is moved upwardly to an appropriate height in a front-end crash ref. to US 5,330,228.

Fig. 13 is a schematic front view of another belt deflector equipped with top and bottom pressure sensitive switches 23, 29 ref. to US 5,330,228.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

The advantages of the preferred embodiments in the Chap. "INDUSTRIAL APPLICABILITY" are outlined hereinafter with regard to the functions and features thereof. A three-point seat belt consists of a shoulder-, lap- and extending belt portion **1.2, 1.3, 1.4**. A multi-point seat belt **1** consists of a first and second shoulder belt portion **1.1, 1.2**, a lap belt portion **1.3** and an extending belt portion **1.4** (**Fig.** 1). Because the shoulder-belt-portion guiding deflector **5, 5a, 5b, 5.10c** is height adjusted, the extending belt portion **1.4** and the belt retractor **13b** can be arranged in the seat backrest **3.2** and fastened to any girder **3.20, 3.20c, 3.20d** of the seat-backrest frame **3.4** or any stiff member thereof (**Figs.** 5, 7, 9, 11), thus saving the conventional height-adjustable D-ring **12**. To make it clear to the reader that there is no restriction on attaching the belt retractor to any wall of the girder **3.20d**, two shafts **13.2, 13.2a** of the spools **13.1** of belt retractors **13b** drawn in solid and dotted lines are shown in **Fig.** 9.

When the height-adjustable head rest is adjusted to the height of the head of any passenger, the shoulder-belt-portion guiding deflector with the shoulder belt portion adapts itself to his body proportion.

When a head rest of fixed height (**Fig.** 3) is integrated into the seat of, for example, a Volvo, a Ferrari or a Porsche, a space-saving, height-adjustable shoulder-belt-portion guiding deflector **5b** can always be installed in either side (free region) **3.22** of the seat backrest **3.2**.

In the 1st to 3rd embodiment the passenger, feeling uncomfortable with the shoulder belt portion **1.2** extending over his shoulder, has to unlock a latch **3.65, 5.65** of the locking handle **5.2, 5,2c** of locking device **80, 80c** (**Figs.** 1, 3, 6A, 6B, 8, 9) and move it to the position „O" (acronym for Open position) (**Fig.** 6B) in order to adjust by about the height of „Δh"

- the height-adjustable head rest **3.6a** or

- the shoulder-belt-portion guiding deflector **5, 5b, 5.10c**, provided either with an aperture **5.9** (**Figs.** 1, 3, 6A, 6B) or with a belt deflector **5c** (**Figs.** 7) or
- the single head-rest tube **5, 5b, 5.10c**, provided either with an aperture **5.9** or with a belt deflector **5c**.

Finally, the shoulder-belt-portion guiding deflector or the single head-rest tube at the appropriate height is locked when that biased latch **3.65, 5.65** moves into, for example, the locking slot „L_2" or „L_3" (**Figs.** 6A, 6B, 8, 9). Owing to the features of being guided by the respective stiff girder **3.20, 3.20d**, moveable therealong, locked therein and nonrotating about a longitudinal centre axis „m_c", „z_c", „V_c" thereof (**Figs.** 4, 6A, 6B, 8, 9) only a single stiff head-rest tube **5, 5b, 5.10c** is needed to receive the head rest **3.6c** and sustain all the crash loads imposed thereon.

Ref. to Chap. h) and **Fig.** 4 a circle with radius of „$r \pm \Delta r$" is defined by a pair of semi-circle shaped portions **5.11b** in contact with a pair of semi-circle shaped edges **3.91b** of the guide tube **3.9b** attached to a girder of the seat-backrest frame **3.4**. The gap „o" prevents the mid-portion **5.10b** of the single stiff head-rest tube **5b** or shoulder-belt-portion guiding deflector **5b** from coming into contact with the mid-portion **3.90b** of the guide tube **3.9b**.

Ref. to Chap. h) and **Figs.** 6A, 6B each of a pair of V-shaped contact-portions **3.60, 5.60** is defined by a pair of slanting members **3.81, 5.81** sliding along each other, having the same slanting angle and converging to the longitudinal axis (convergence line) „V_1" or „V_2". The pair of V-shaped contact-portions **3.60, 5.60** serves as a dividing wall to protect the shoulder belt portion **1.2** from coming into contact with the members of locking device **80** and being damaged thereby. The locking device **80** comprises

- a shaft **3.64**, projecting through the fixed girder **3.20** and a pair of first ends of levers **3.66**, secured to the shaft **3.64** by a pair of pins **3.62**, and one end of which fastened to a locking handle **5.2**,
- the movable, shoulder-belt-portion guiding deflector **5** or single movable, head-rest tube **5**, provided with a plurality of locking slots „L_1" to „L_n" („L_2", „L_5" to „L_8" drawn), where i = 1 to n,
- the latch **3.65**, projecting through the movable, shoulder-belt-portion guiding deflector **5** or single movable, head-rest tube **5**, a pair of second ends of levers **3.66** and a pair of first eyes of leaf springs **3.63** and secured by a pair of retaining rings **3.67**, and

- a pair of rivets **3.68**, each of which with a distance sleeve **3.71** protruding through a second eye of leaf spring **3.63** and fastened to the movable, shoulder-belt-portion guiding deflector **5** or single movable, head-rest tube **5** by a tool inserted through an opening **3.61**.

In response to the rotation of the locking handle **5.2** in co-operation with the pair of levers **3.66** the latch **3.65**, being detached from the locking slot „L_2", moves in a pair of oblong holes **3.69** of both side walls of the fixed girder **3.20** from the position „C" to the position „O". The movement of latch **3.65**, biased by the pair of leaf springs **3.63**, to the position „O" is limited either by the stretched length of the leaf springs **3.63** or by the edges of the oblong holes **3.69**. When an appropriate locking slot „L_a" is found, the biased latch **3.65** moves therein and in the pair of oblong holes **3.69** back to the position „C".

Ref. to Chap. h) and **Figs.** 7 to 11 a circle with radius of „$r_1 \pm \Delta r_1$" is defined by two pairs of quarter-circle shaped tube-edges **5.45** of the single stiff, movable, head-rest tube **5.10c** or movable, shoulder-belt-portion guiding deflector **5.10c** in contact with two pairs of quarter-circle shaped girder-edges **3.45** of the fixed girder **3.20c, 3.20d**. The gap „o_1" prevents the tube-walls **5.41 to 5.44** from coming into contact with the girder-walls **3.41 to 3.44**. A dividing tube-wall **5.49** protects the shoulder belt portion **1.2** in a space **5.40** from coming into contact with the members of locking device **80c** in a space **5.50** and from being damaged thereby. The shoulder belt portion **1.2** is inserted

- through an opening **5.25** of the belt deflector **5c**,
- through the single stiff, movable, head-rest tube **5.10c** or movable, shoulder-belt-portion guiding deflector **5.10c** via an opening **5.35** and the space **5.40** and
- through the fixed girder **3.20c, 3.20d** via a space **3.40** and an opening **3.25, 3.25d** attached to the shaft **13.2** of belt retractor **13b**.

The locking device **80c** comprises

- the single movable, head-rest tube **5.10c**, provided with a plurality of locking slots „L_1" to „L_n" („L_1" to „L_7" drawn), where i = 1 to n,
- the latch **5.65**, biased by a coil spring **5.63**, sustained by a spring washer **5.66a** of a guiding sleeve **5.66** and a latching sleeve **5.61** secured to the latch **5.65** by a pin **5.62**, and guided by the guiding sleeve **5.66** having a rectangular attachment base **5.66b**, where the latch **5.65** is inserted through a girder-hole **3.70** of the girder **3.20c, 3.20d** and a tube-hole

5.70 of the single stiff movable, head-rest tube **5.10c** until the attachment base **5.66b** comes into contact with to a side tube-wall **5.43** of the single stiff movable, head-rest tube **5.10c** and, finally, is fastened thereto by two bolts **5.67**,

- a locking handle **5.2c**, fastened to one end portion of the latch **5.65** by a pin **5.68**.

When the locking handle **5.2c** is pulled in the arrow-direction „P" the latch **5.65** is detached from the locking slot „L_3". The height of the single movable, stiff head-rest tube **5.10c** or movable, shoulder-belt-portion guiding deflector **5.10c** can be adjusted.

A connecting threaded rivet **5.33** consists of a threaded portion **5.33a**, deformable portion **5.33b** and chamfer portion **5.33c**. By means of a tool the surface **5.33d** is pressed onto the chamfer while the threaded portion **5.33a** is pulled into the attachment hole **5.32**. As a result the deformable portion **5.33b**, deformed, is tightly seated on the surface front tube-wall **5.44** and in its attachment hole **5.32**.

Because the shoulder-belt-portion guiding deflector **5, 5a, 5b, 5.10c** is height adjusted, the extending belt portion **1.4** and the belt retractor **13b** can be arranged in the seat backrest **3.2** and the belt retractor **13b** is fastened to its seat-backrest frame **3.4** (**Figs.** 5, 7, 9, 11), thus saving the conventional height-adjustable D-ring **12**.

Any adaptor, as known in the art such as a clip **40** consisting of two pieces **40.1, 40.2** with diameter „D" of 16 mm and height „h" of 2.6 mm, found in Opel cars and made from plastic (**Figs.** 1, 1A to 1C), is suited for loosely retaining a released main latch plate **9** in a resting position „NU" (acronym for Non-Use) between the shoulder-belt-portion guiding deflector **5, 5a, 5b, 5.10c** (**Figs.** 1 to 3, 5) and the seat cushion **3.1** so that the seat belt is retracted through the shoulder-belt-portion guiding deflector by the belt retractor **13, 13b** until the spool, containing the excess belt portion **1.41**, is full. If the released main latch plate **9**, loosely retained by the main-latch-plate adaptor **40** is located in the resting position „NU" between the shoulder-belt-portion guiding deflector **5, 5a, 5b, 5.10c** and the seat cushion **3.1**, preferably, at a height of his elbow **50** the seated passenger can easily access it. The length of the excess belt portion **1.41**, denoted by „l_{NU}" (**Fig.** 1) for a normal size of passenger, is protracted to restrain him when the main latch plate **9** is plug-in connected to the main buckle assembly **9.1** in an operative position „U" (acronym for Use). The main-latch-plate adaptor **40**, consisting of two pieces **40.1, 40.2**, is so positioned on the lap belt portion **1.3** and fastened thereto that it does not interfere with the main latch plate **9** in plug-

in connection with the main buckle assembly **9.1** when the seat belt is retracted and finally blocked by the belt retractor and pretensioner **13, 13b** in real-world accidents. To facilitate an intrusion a stud **40.11** of the first piece **40.1** has a cone-shaped end **40.12** and a hole **40.12** of the piece **40.2** has two chamfers **40.22, 40.23**. When the first piece **40.1** is pressed into the second piece **40.2**, the cone-shaped end **40.12** intrudes through the lap belt portion **1.3** and damages its belt webbing **1.31**. By means of a pliers the stud **40.11** with diameter „d_1" intrudes through the belt webbing **1.31** into a space, defined by itself and the hole **40.21** with diameter „d_2" bigger than „d_1", and into the hole **40.21** and jams therein.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.